



Energy Efficiency and Renewable Energy
Federal Energy Management Program

How to Buy an Energy-Efficient Residential Gas Furnace

Why Agencies Should Buy Efficient Products

- Executive Order 13123 and FAR section 23.704 direct agencies to purchase products in the upper 25% of energy efficiency, including all models that qualify for the EPA/DOE ENERGY STAR[®] product labeling program.
- Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.
- As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy efficiency, while saving taxpayer dollars.

For More Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-efficient federal procurement, including the latest versions of these recommendations.
Phone: (800) 363-3732
www.eren.doe.gov/femp/procurement
- Environmental Protection Agency has ENERGY STAR[®] furnace listings.
Phone: (888) 782-7937
www.energystar.gov
- American Council for an Energy-Efficient Economy (ACEEE) publishes the *Consumer Guide to Home Energy Savings*.
Phone: (202) 429-0063
aceee.org
- Air Conditioning Contractors of America (ACCA) publishes *Manual J*, a load calculation guide for residential heating and air conditioning, and *Manual S*, a sizing guide for heating and cooling equipment.
Phone: (202) 483-9370
www.acca.org
- *Home Energy* magazine provides energy conservation tips.
Phone: (510) 524-5405
www.homeenergy.org
- Gas Appliances Manufacturers Association (GAMA) publishes *Consumer's Directory of Certified Efficiency Ratings*.
Phone: (703) 525-9565
www.gamanet.org
- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation.
Phone: (202) 646-7950

Efficiency Recommendation

Product Type	Recommended AFUE ^a	Best Available AFUE
Residential Gas Furnace ^b	90% or more	97%

a) Based on DOE test procedure, see 10 CFR 430, Sub-Part B, Appendix N.

b) Residential gas furnaces include those fired by natural or propane gas, with input ratings less than 225,000 Btu/hour.

For furnaces purchased through commercial sources (retailer or distributor), look for the EPA/DOE ENERGY STAR[®] label; all ENERGY STAR models meet this Efficiency Recommendation. Alternatively, look at the yellow "EnergyGuide" label to identify models with an AFUE that meets the recommended level.

For a contractor-supplied gas furnace, specify an ENERGY STAR qualified model, or one with an AFUE that meets the recommended level.

All models that meet the recommended levels are "condensing" furnaces. This technology takes advantage of normally exhausted heat in the furnace's flue gas. Condensing furnaces require slight modifications in installation and usually are considerably more expensive than standard efficiency models; consult the cost-effectiveness information (on Page 2) to help determine the range of price premium that is justified for your location and fuel price.

Oversizing of furnaces, besides raising purchase cost, will result in weaker energy efficiency due to excessive on-off cycling. The required furnace capacity should be determined based on the referenced ACCA calculation procedure (see "For More Information").

Definition

AFUE (Annual Fuel Utilization Efficiency) is a measure of heating efficiency on an annual basis. The DOE test procedure defines AFUE as the heat transferred to the conditioned space divided by the fuel energy supplied.

How to Select an Energy-Efficient Furnace



Condensing Furnaces

Sizing

Average U.S. homes lose more than a quarter of their heating energy through leaky ductwork. Poor sealing of ducts can also generate comfort problems and, in some cases, cause backdrafting of gas-fired equipment (furnaces and water heaters). Ductwork should be inspected and sealed in conjunction with furnace installation.

Duct Sealing

Consider leaving your furnace off during unoccupied hours or using a set-back thermostat to minimize unnecessary operation of the unit.

User Tips

Furnace Cost-Effectiveness Example (70,000 Btu/hour)			
Performance	Base Model ^a	Recommended Level	Best Available
AFUE	78%	90%	97%
Annual Energy Use	790 therms	685 therms	635 therms
Annual Energy Cost	\$320	\$270	\$250
Lifetime Energy Cost	\$4,600	\$4,000	\$3,700
Lifetime Energy Cost Savings	–	\$600	\$900

Definition

Lifetime Energy Cost is the sum of the discounted value of annual energy costs based on average usage and an assumed furnace life of 20 years. Future gas price trends and a discount rate of 3.4% are based on federal guidelines (effective from April, 2000 to March, 2001).

a) The efficiency (AFUE) of the Base Model is just sufficient to meet current U.S. DOE national appliance standards.

Cost -Effectiveness Assumptions

Annual energy use in this example is based on the standard DOE test procedure for a model with a heating capacity of 70,000 Btu/hour and 2,080 heating load hours. The assumed gas price is 40¢/therm, the federal average gas price in the U.S.

Using the Cost-Effectiveness Table

In the example shown above, a furnace with an AFUE of 90% is cost-effective if its purchase price is no more than \$600 above the price of the Base Model. The Best Available model, with an AFUE of 97%, is cost-effective if its price is no more than \$900 above the price of the Base Model.

What if my Gas Price, Heating Load Hours, or Capacity are different?

To calculate annual or lifetime savings for a different gas price, multiply the savings in the above table by this ratio: $\left(\frac{\text{Your price in } \$/\text{therm}}{40.0 \text{ } \$/\text{therm}}\right)$. Similarly, for a different heating load,

multiply the savings by this ratio: $\left(\frac{\text{Your heating load hours}}{2080}\right)$. Heating load hours for your

region can be estimated from maps available in several references, including Appendix B1 (Figure 2) of this binder and the Code of Federal Regulations (10 CFR 430, Sub-Part B, Appendix N). For a different size (capacity) furnace, multiply savings by:

$$\left(\frac{\text{Your capacity in Btu/h}}{70,000 \text{ Btu/h}}\right).$$

Metric Conversions

1000 Btu/h = 293 watts
 1 therm = 100,000 Btu
 = 29.3 kWh
 = 105.5 MJ
 $^{\circ}\text{F} = (1.8 \text{ } ^{\circ}\text{C}) + 32$

